ANALYSIS OF COMMON ERRORS COMMITTED
BY
PUPILS IN PHYSICS
AT PLUS TWO ANNUAL EXAMINATION (1995)
CONDUCTED BY CHSE, ORISSA.

NCERT. (1996-97)

DR. (MRS.) Madhuri Mohapatra
Programme co-ordinator.

Regional Institute of Education
(National Council of Educational Research and Training)
Bhubaneswar - 751007

DLDI, NCERT
30.07095413
ANA(N-R)
F21314

FOREWARD

A workshop entitled " Analysis of Common Errors commited by pupils in Physics at +2 Examination conducted by CHSE orissa " organised during the period from dt. 7. 10. 96 to 10.10 96 in this Institute . Before the workshop was undertaken, a sample survey of 500 answer scripts (250 paper I , 250 paper II) of the +2 Annual Examination, 1995 was collected from CHSE, and was requested to provide the answer scripts following random selection procedure In order to make the analysis of the errors, a format was developed The scripts were analysed by the faculty members leaving few scripts to be analysed in the workshop This procedure was adopted with a view that the partcipants will also to be acquainted with analysis procedure. In the workshop the activities like analysis of the answer scripts by the participants using the given format, listing the errors, analysis of the errors, analysis of the text book in view of the errors were undertaken by the partcipants On the basis of such analysis, a training package in physics for teaching of +2 level will be developed in the follow up programme

I appreciate the efforts of Dr (Mrs) Madhuri Mohapatra , Programme Co-ordinator for organising the programme and for bringing out the report

(Prof. D K Bhattacharjee)
Principal

PREFACE

The five days workshop entitled "Analysis of common errors commited by pupils in Physics at +2 examination conducted by CHSE (coucil of Higher Secondary Education), Orissa" was organised by the RIE, Bhubaneswar from 7th october to 10th october This programme is a PAC (Programme Advisory committe) approved programme and was undertaken by the institution in consultation with the council of Higher Secondary Education Orissa.

In the first phase of the programme formats were developed to analyse the errors and questions papers In the second phase of the progamme the workshop was organised. This report is based on the analysis of 230 answer scripts from paper - I and 180 answer script from paper - II. Six types of errors had been identyfied and analysis was done accordingly. Details of analysis along with defects in the questions and question pattern are in the perview of this report In the concluding discussion some remedical suggestion for elimination of common errors committed by the students were reported

I wish this report will be at a great help to the question setters as well as the physics teachers of +2 level

ACKNOWLEDGEMENTS

My special thanks are due to Dr D K Bhattachrjee, principal RIE Bhubaneswar for his continued support and constant encouragement in organising this programme.

I am thankful to the faculty members of physics department for extending their valuable co - operation in preparing the formats for analysis and analysing the answer scripts.

My thanks are due to Director Higher Education, Orissa , Bhubaneswar for deputing the examiners of physics for the workshop

I shall be failing in my duty if I do not thank the partcipants and the resource persons who made the workshop fruitful

I am also thankful to the staff of extension department of this institue for their cooperation and support

My thanks are also due to M/S PARAGON for their support for the publication of this report in the final form

Dr (Mrs). Madhuri Mohapatra
programme cordinator.

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INTRODUCTION

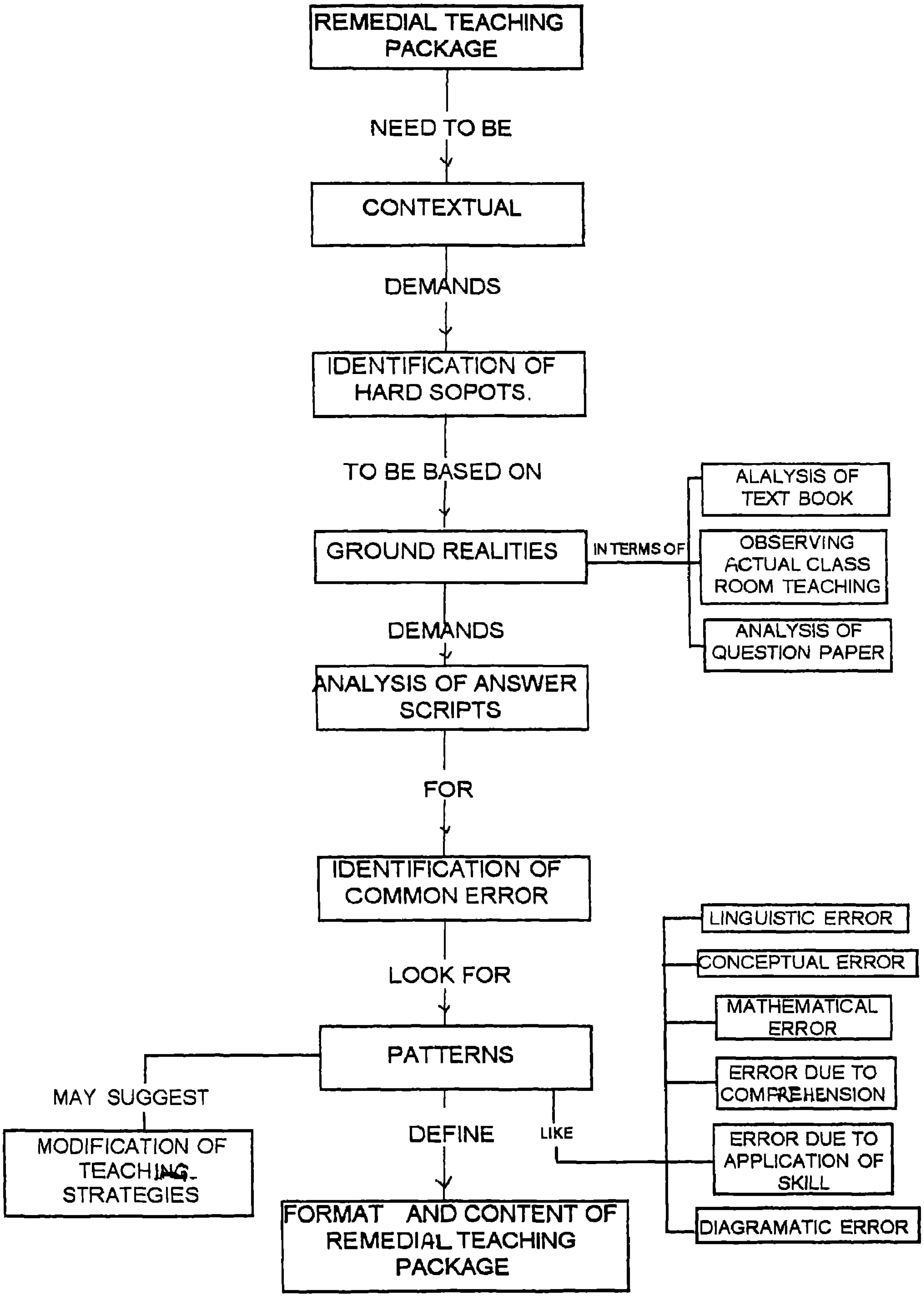
REMEDIAL TEACHING PACKAGE
NEED TO BE
CONTEXTUAL
DEMANDS
IDENTIFICATION OF HARD SOPOTS.
TO BE BASED ON
GROUND REALITIES
IN TERMS OF
ALALYSIS OF TEXT BOOK
OBSERVING ACTUAL CLASS ROOM TEACHING
ANALYSIS OF QUESTION PAPER
DEMANDS
ANALYSIS OF ANSWER SCRIPTS
FOR
IDENTIFICATION OF COMMON ERROR
LOOK FOR
PATTERNS
MAY SUGGEST
MODIFICATION OF TEACHING STRATEGIES
DEFINE
FORMAT AND CONTENT OF REMEDIAL TEACHING PACKAGE
LIKE
LINGUISTIC ERROR
CONCEPTUAL ERROR
MATHEMATICAL ERROR
ERROR DUE TO COMPREHENSION
ERROR DUE TO APPLICATION OF SKILL
DIAGRAMATIC ERROR

Fig.1. Map representation of the back ground and concept of the work.

OBJECTIVE OF THE STUDY

2. OBJECTIVES OF THE STUDY :

The major objective of the programme are -

1 To identify common errors made in answering the questions by the students in +2 physics examination , 1995

2. To make the list of these errors available to the teachers for taking necessary corrective steps while teaching

3. To find the cause for such errors The error may be in relation to

   (i) Text book

   (ii) Defective teaching

   (iii) linguistic

   (iv) Diagramatic ect .

4 To analyse the question papers

5. To suggest some remedial measures basing on which a remedial teaching package may be prepared in the follow - up programme

METHODOLOGY OF ANALYSIS

3. METHODOLOGY :

The methodolgy adopted in conducting this study was as follows-

3.1 SELECTION OF ANSWER SCRIPTS :

The council of higher secondary education (CHSE) was requested to provide 500 answer scripts (250 - paper - i , 250 - paper - ii) of the +2 examination , 1995 following random selection procedure Thus the selection of the answer scripts was left entirely on the council and the answer scripts provided by the council were analysed as such Due to language constrains the answer scripts selected were all in english

3.2 DEVELOPMENT OF A FORMAT FOR THE ANALYSIS OF THE ANSWER SCRIPTS :

A format or a tool to evaluate the papers uniformly was developed by the faculty members of the physics department in consultation with education department The format for reference is given in Appendix - I The format deals with all possible types of errors that can be expected from an examinee in physics The performa analyses six different errors which includes both qualitative and quantitative aspects of identifying the common errors The errors were classified under seven categories viz -

1. Conceptual error.

2 Linguistic error

3. Diagramatic error

4. Error due to comprehension.

5. Error due to problem solving skill

6 Error due to rote learning

7. Any other types of error .

The format also includes some opinion regarding the questions

(i) Question wrongly framed

(ii) The question is Information, knowledge, application or skill based

3.3. ANALYSIS :

The scripts were analysed by the faculty members of the physics department leaving few scripts to be analysed in the workshop by the participants. This is adopted so that the participants get acquainted with the analysis procedure

3.4 WORKSHOP :

A five days workshop was organised from 7th october to 10th october in RIE , Bhubaneswar entitled " Analysis of common errors committed by pupils in physics at +2 examination conducted by CHSE, orissa " Twenty participants from different government colleges of orissa those who have evaluated the answer scripts of +2 annual examination 1995 were invited out of which only seven of them were reported in th workshop One resource person has also been invited

Forty answer scripts were analysed in the workshop which includes twenty from each paper. The analysis work involved reading each and every answer written by the examinee and to locate the error committed by them in the given format Marks secured by the examinee was ignored during the process of analysis. However it was noticed that marks given by the examiner in some cases were not proper

DETAILS OF ANALYSIS

4. DETAILS OF ANALYSIS :

Question papers as well as answer scripts were analysed

4.1 ANALYSIS OF QUESTION PAPERS :

There were two sets of question papers of seventy five marks each in physics for higher secondary examination 1995 conducted by CHSE orissa The details of physics paper - I & physics paper - II are given in appendix - ii. In each set various types of questions like long answer, short answer and very short answer or objective type of questions were asked from different units. In both the papers there were three groups Group A contains very short answer questions of one mark each & Group B contains short answer questions of two marks each Group C contains long question of ten marks each. The examinee was supposed to answer all fifteen questions from group - A, ten questions from group - B, four questions from group - C.

The courses of studies for physics paper - i and paper - ii both consists of seven units and each units is again divided into sub-units. The examination pattern is mentioned in the syllabus as follows The question of each group is formed to test the -

(i) knowledge

(ii) comprehension / understanding

(iii) application of skill

Each of the question paper should contain 40% of the questions based on the knowledge. 40% of the questions based on comprehension / understanding and 20% of the question based on application of skill According to the given guide line the question setter should set the question.

4.1.1 ANALYSIS OF PAPER - I :

It consists of seven units .The units are -

Units - i	Physical world and measurement
Units - ii	Motion
Units - iii	Circular motion, rotational motion and moment of inertia.
Units - iv	Gravitation and projectile motion
Units - v	Waves and oscillation
Units - vi	Properties of matter.
Units - vii	Heat and thermodynamics

Group - A, Group - B & Group - C in the question paper is supposed to cover all units however lot of discrepancies have been observed and are depicted in table - 1.

TABLE NO. 1

Analysis of question paper - I.

Name of the group	No of the units of the syllabus		total
	Represented	Unrepresented	
A	7	NIL	7
B	6	1	7
C	5	2	7

In group - B there was not a single question from unit - 3 and in group - C not a single question was asked from unit - 1 and unit - 3

Group - A contains fifteen questions, out of which -

Knowledge based questions - 3 (20%)

Understanding based questions - 7 (46%)

Application of skill based questions - 5 (33%)

Group - B also consists of fifteen questions, out of which -

Knowledge based questions - 4 (26%)

Understanding based questions - 3 (20%)

Application of skill based questions - 8 (53%)

Comparing the examination pattern mentioned in the syllabus it is observed that there is a lot of disparity in setting the questions of group - A & group - B

Group - C contains six questions out of which -

Question - 4 & 5 require knowledge and understanging to answer

Question - 6 requires understanding and application of skill to answer

Question - 8 requires knowledge and application of skill to answer

Question -10 requires knowledge and application of skill to answer as the question asks the mathematical expression for progressive & stationary waves and their graphical repsentation

In fig - I, type of question and percentage of a particular question asked in paper - 1 is plotted The solid line represent the guide line given in the syllabus for the question paper and the dotted lines represent the pattern of question actually asked in the examination.

On comparision it is observed that neither for group - A nor for group - B the prescribed percentage of type of questions to be asked in the examination was followed

4.1.2 Analysis of paper - ii

Like paper - I, it also contains seven units, viz -

Unit - i	Electrostatistics and magnetostatistics.
Unit - ii :	Current electricity
Unit - iii	Electromagnetic induction and altering currents.
Unit - iv	Optics
Unit - v	Atomic physics & relativity.
Unit - vi	Nuclear physics.
Unit - vii	Solids & electronic devices

Group - A, B, & C are supposed to contain questions from all units The number of units represented and unrepresented in the questions is depicted in table - 2.

TABLE NO. 2

Analysis of question paper - ii.

Name of the group	No of the units of the syllabus		total
	Represented	Unrepresented	
A	7	NIL	7
B	6	1	7
C	5	2	7

In group - B there was not a single question from unit - 3 and in group - C not a single question from unit - 2 & unit - 5 were asked

The questions are to be asked in the given proportion between knowledge understanding and application of skill In paper - ii the distribution is as given below

Group - A contains fifteen questions, out of which -

knowledge based question - 8 (53%)

Understading based question - 5 (33%)

Application based question - 2 (13%)

Group - B contains fourteen questions out of which-

Knowledge based question - 5 (36%)

Understading based question - 8 (57%)

Application based question - 1 (7%)

Group - C contains seven questions out of which -

Knowledge based question - 3 (43%)

Understading based question - 3 (43%)

Application based question - 1 (14%)

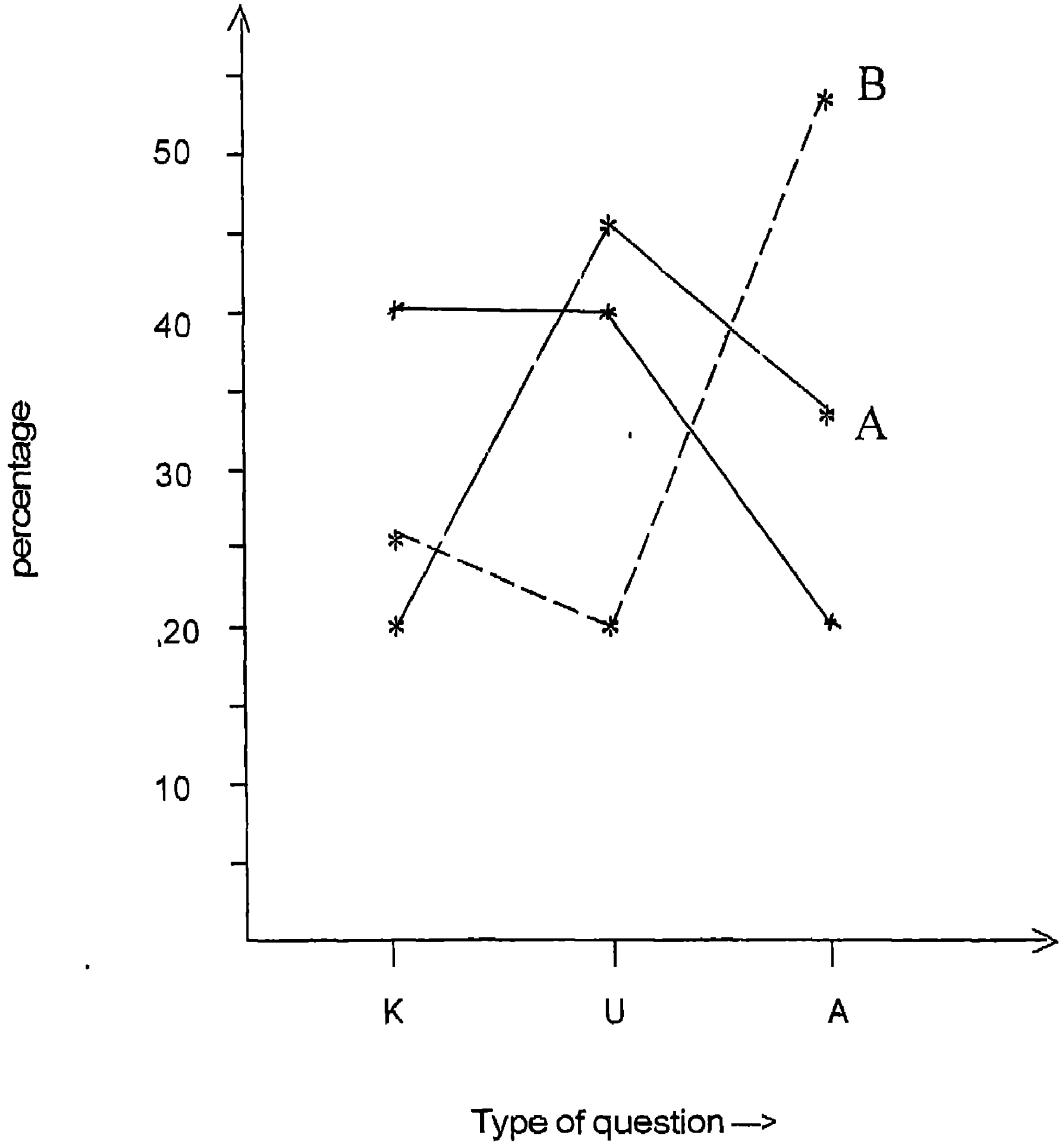

Fig - I . Type of question and percentage of a perticular question asked in paper - 1

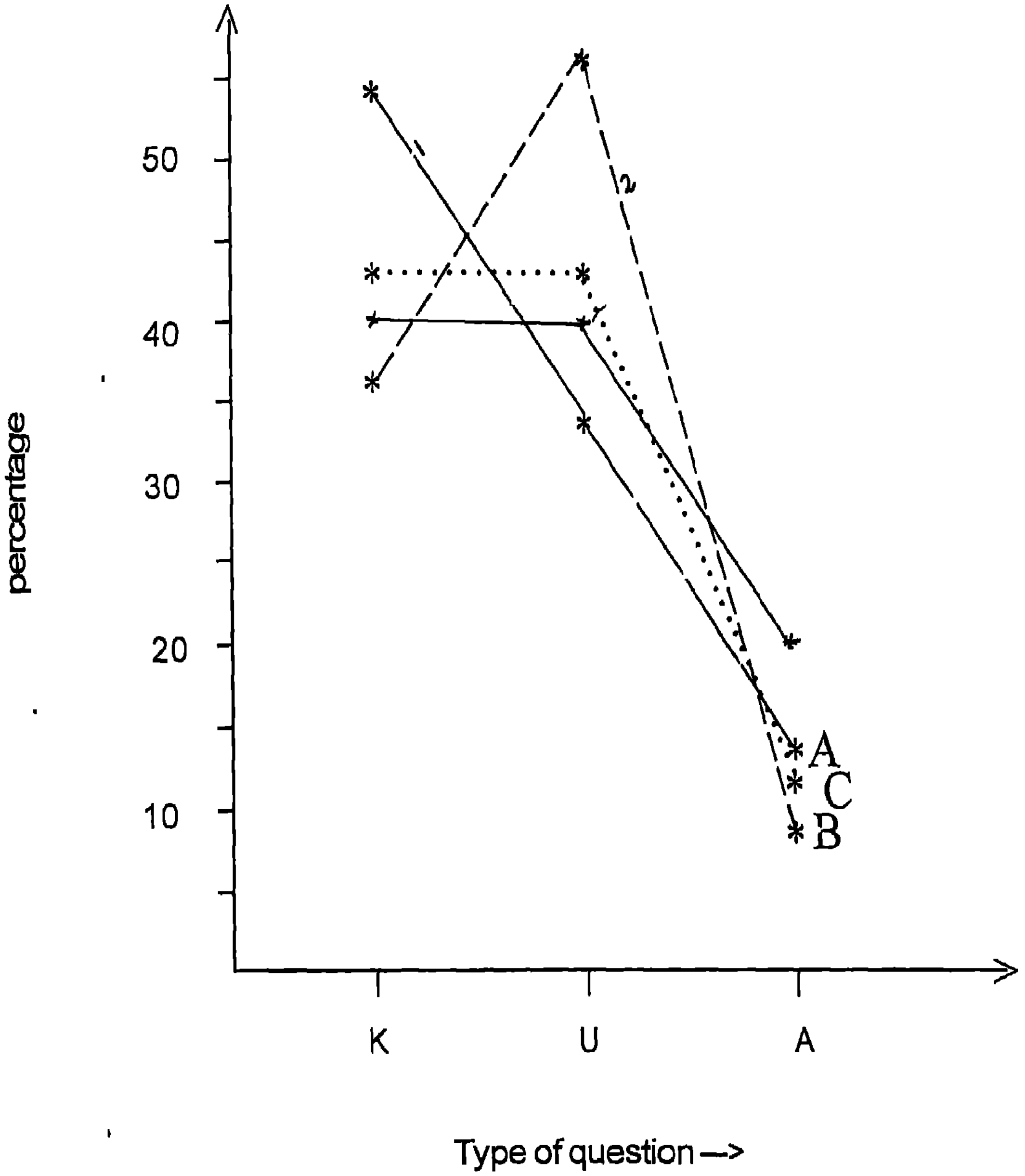

Fig - II . Type of question and percentage of a perticular question asked in paper - 2

Thus a lot of disparity is being observed in setting the questions.

In fig - 2, the type of question and percentage of a particular question asked in paper - II is plotted The solid line represent the guide line given in the syllabus to set the question paper The dotted line shows us the percentage of a particular type of questions asked in each group. Comparing it is observed that only in group - C the question setter had followed the guide line. The line (1) & line (2) represent group - A & group - B and do not follow the prescribed guide line

In some of the questions it is observed that the students can answer the question just by putting the data in a given formula Those questions are categorised as question which need a bit of skill to answer and are categorised as skill based questions The detail of analysis of the answers of paper - I & paper - II are discussed in tabular form in table - 3 and table - 4. To write the remedial teaching package types of common error committed by the students are identified, however in some cases it is difficult to asses the common errors and in those cases specific examples of error committed are presented as such from the answer scripts Each answer script was analysed as per the developed format. In the analysis table, the meaning K, U, A & S are as follows -

K - Knowledge

U - Uderstanding

A - Application

S - Skill

4.1.3 DEFECTS IN THE QUESTION PAPERS :

Defects in the question papers leading to error in answering the questions

Paper - i.

Q No 2F: The question is not specific.

The questions should have been Write the dependence of r m s velocity of a gas on its change of pressure The Oriya version is not proper

Q.No 2G. This question is wrongly framed .

The question should have been Write down Stoke's formula

Q No. 3O This question is wrongly framed

It should have been State relation between specific heat and water equivalent of a body.

Q No 5 : This question has linguistic error

It should have been - " State the laws of friction Obtain the expression for maximum or limiting speed of a vehicle while taking a curve on a banked road having friction

Paper - ii

Q No. 1b. This question is wrongly framed.

It should have been - under what condition galvanometer becomes "dead beat".

Q.No 1c This questions is wrongly framed

It should have been State the relationship between electricfield intensity and potential at a point.

Q No.2F1: The question is not specific to get a proper answer The question was What is an objective lens ?

Q No.3G: This question is not specific.
It should have been · Explain forward biasing in a PNP transister

Q NO 4 The deviation of the expression for the fringe width with monochromatic light is out of syllabus

Q No 6 . This question is wrongly framed

It should have been - Derive expressions for the equivalent capacities of capacitors joined in series and parallel

4.2. ANALYSIS OF THE ANSWER SCRIPTS :

As already mentioned each answer given by the examinees in the answer scripts were critically analysed The common errors i e the types of error committed by a maximum number of students are listed out and are given in table - 3 & table - 4. The main errors which are repeated frequently are reported under the heading " Indicators for error diagonosis / specific examples of error committed " and the examples are written as such from the answer scripts without any alteration

The sixth column contains the listing of diagonostic error (or) the causative factor for such error.

Table No. 3

Question wise analysis of student response paper - 1

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students
1a	U	93 4	46.0	$ML^{-1}\ T^{-1}$	very few students have the concept of dimension and derived it starting from energy / frequency	conceptual.
1b	U	95 6	31 1	If the two vectors are equal then the cross product of two vectors will be zero	Dose not cover all cases	conceptual
1c	A	99 1	50 8		Ignorance of the mathematical relation between kinetic energy and momentum	conceptual
1d	S	95 6	56.8	Displacement time graph is parellal to the t - axis then the velocity of the body is constant	Not able to interpret s - t graph	conceptual

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no of students.
1e	U	91.3	10 4	Acceleration due to gravity provides the centripetal force when a cyclist takes a turn	Not able to realise gravitational force cannot have componet in horizontal direction	conceptual.
1f	U	80 4	25 4	Moon surrounding the earth is the cener of mass out side the body	Not able to give example of a single body like ring	conceptual
1g	A	88 3	33 7	The magnitude of gravitational force of moon on earth is 1 / 9 F if F is the gravitational force of earth on moon.	Lack of understanding of third law of motion	conceptual
1h	S	89.1	37 5	Time period of a simple pendulum inside an earth satellite is 1m	Not able to realise conceptually that g = o in a satellite	conceptual

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students
2a	K	83.0	17.6	The frequency of trasverse vibration depends upon density of vibration and inversely proportional to mass per unit length	Answer is not to the point and frequency is inversely proportional to mass but root over to mass per unit length.	conceptual and comprehension
2b	U	94.7	14.1	The chage in phase occurs from rarer to denser	Not able to specify magnitude of the change	conceptual & linguistic
2c	U	82.1	58.2	Hair has a capacity to attract each other	Not able to relate with concept of surface tension	conceptual
2d	A	93.4	15.8	0°c of 15 gm of water will require 0°c of heat to convert 0°c of 15 gm of water	The students lack the idea of latent heat and change of state.	conceptual +problem solving skill
2e	K	83.0	61.8	Black colour can receive the heat quickly and easily so the substance heats of quickly	Not able to use scientific terminology "good absorber"	conceptual + linguistic

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no of students.
2f	U	90	35.0	Pressure is directly proportional to square of velocity.	Lack the mathematical ability to invert the relationship	conceptual .
2g	K	45 6	45 8	F= 6Π η rv	Not able to articulate the law verbally.	conceptual
3a	A	66 9	16.8	$\lvert\vec{A}+\vec{B}\rvert=\lvert\vec{A}\rvert+\lvert\vec{B}\rvert+2\vec{A}\,\vec{B}\,COS\,\theta$	Lacks complete understanding of addtion of vectors	conceptual
3b	A	72.6	16 7	Velocity is 2m / sec after 10m hence it is 8m /sec after 40m	Mistaken accelerated motion as uniform motion	Problem solving skill
3c	K	67 8	19.1	The condition for equlibrium of body is when normal reaction is equal to its weight	Condition of equlibrium through a fundamental concept it lacks with student	compression

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no of students.
3d -	U	10.3	58.6	Angle of friction equal to angle of repolse TAN α = TAN μ.	Not able to conceptualise as well as state mathematically	conceptual.
3e	A	58 6	10 3	Moment of inertia = (1 / 2) M^2R^2	Mathematical relation lacking	conceptual.
3f	A	73 4	31 6	Both the bodies will come to rest	Lacks application of skill as well as the knowledge of conservation of energy and momentom	conceptual and comprehension.
3g	K	58 2	11 1	Time period is proportional to cube of the radius	Not able to recall the relation correctly. ($T^2 \alpha\ r^3$)	conceptual
3h	S	55 6	7 0	Relation between acceleration and time for a simple pendulum	Lack skill of drawing graph	conceptual

Question No	Type of question	% of student attempted	% of student giving correct	Indicators for error diagnosis/ specific examples of error response	Diagnostic error committed	Types of error commited by max no of students
3i	S+A	74 7	30 2	$T_2 = 127$ °c $T_1 = 227$ °c efficiency = $1 - T_2 / T_1$ = 100 / 227 °c	Not able to convert the temp to kelvin scale	Problem solving skill.
3j	A	51 7	8 4	While solving the problem proper steps not followed	$\Delta P = 4T / r$, this relationship is not known to many students	conceptual.
3k	U	79 1	17 5	Roof are not strong Hence they blow off	Lacks application and concept of Bernouli's principle	conceptual
3l	K	79 1	34 0	$E = \sigma T^4$	Lacks ability to articulate verbally	Rote learning.
3m	A	49.1	0.8	240 / 9 = X / 25	Lacks the knowledge of correct relationship and correct approach.	comprehension

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no of students.
3n	K	60.8	22 8	Law of equilibrium means the equal distribution of energy	Lacks knowledge of exactly re- - producing the statement.	Rote learning
3o	U	55 2	9.4	Water equivalent of a body is numerically equal to specific heat	Lacks of knowledge of water equivals and specific heat	conceptual .
4	K+U+A	79 1	9.88		No knowledge of correct concept.	conceptual & comprehension .
5	K+U+A	56 0	3.8		Anwer incomplete in most cases Derived up to tan $\theta = V^2 / rg$ however expression for best speed is not derived.	conceptual
6	U+A	78 6	6 07		2nd part of the question not att- -empted by most of the students.	conceptual and problem solving.

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no of students.
7	U	60 0	8 6		Derivation incomplete and the idea for formula of velocity of sound is not clear	Comprehension
8	K+A	83 9	11 3		Figure showing the relationship between stress and strain not drawn, numerical part not atte- - mpted	conceptual.
9	K+U	77 8	9 4		PV diagrames not drawn Adia-batic process incorrectly defined. Derivation of work done partially attempted	conceptual.
10	K	52.6	0.8		Mathematical reprentation of progressive wave and stationary wave & graphical representation of those waves and examples not presented	conceptual

Table no - 4

Question wise analysis of students response - paper - II.

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no of students.
1a	K	93 3	22 6	1 When a magnet put into an electic current it deflect its needle to dip This characteristics of magnet is known as magnetic dip. 2. magntic dipole is defined as the two equal and opposite mag - -netic substances separated at a distance of very close to each other	1 Magnetic dip is confused with magntic dipole. 2. Magnetic meridian is confused with radians	conceptual
1b	U	85	0 6	When current stops the galva-nometer stops deflected	1 Answer incomplete in most of the cases (It stops without further osci- - llation)	conceptual

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
1c	K	90.5	24.5	$E = V / d$.	Not able to distinguish between potential difference and electric field.	Comprehension
1d	U	81.6	33.1	The base in an n-p-n transister is thinner than emitter and collector because due to this the electrons from emitter can pass through it and reach easily to the collector	Basic working of a transistor is not clear to the students.	Comprehension.
1e	K	88.8	33 1	Cobalt ($_{60}co^{12}$) and radio Sodium ($_{11}Na^{24}$) are used as tracers	confusion between diagnostic use and theraptic use of isotope	Rote learing.
1f	A	88.8	3.7	1 $\lambda = h / mv$ 2. $\lambda \alpha$ (kinetic Energy) $^{-1}$	Unable to derive relationship between λ and E	conceptual

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
1g	K-	91.6	44.8	Sodium chloride is the example of covalent bond	Confusion between ionic and covalent bond.	conceptual
1h	U	86.8	3 8	Sun is the source of energy in fusion	The question is not specific	conceptual
2a	K	96 1	30 6	Example of diamagnetic substances are wood and rubber. Example of Paramag-netic substance is sulphur.	Example cited for dia and paramagnetic substances are wrong	Rote learning.
2b	U	86.6	1 3	$\sqrt{1-v^2/c^2}=1$ is the condition under which Lorentz trasformation to Galilean tranformation	Lack of interpretation of the condition.	conceptual.
2c	U	93 3	16.0	Minimum frequency is called threshold frequency.	Lack of understanding	conceptual.

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
2d	K	91.1	14 6	Self inductance is defined as the amount of emf produced in a coil.	Not able to distinguish between inductance and induced emf.	Rote learning.
2e	K	89 4	31 6	Liquid hydrogen or Hydrogen in its liquid form is the isotope of hydrogen and is called heavy hydrogen		conceptual.
2f	K	88.3	30 8	Objective less is the lens which is placed near the object	Answer not specific and without any reference to telescope and microscope	conceptual
2g	A	87 2	17 8	Radial magnetic field is used beacause it is capable of rotating	Not able to realise the concept of a radial magnetic field.	conceptual
3a	U	90	18 5	In a nuclear force there are three types of forces like electron, proton and neutron force.	Not able to distinguish between electric forces and nuclear force.	conceptual.

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
3b	K+A	12.6	87 7	${}_8O^{15} + {}_1H^1 = {}_6C^{12} + {}_2He^4 + {}_1e^0$	Lacking the concept of balance of an equation	Problem solving and conceptual.
3c	U	6 2	80.5	It depends on the angle of the prism and velocity of the wave	The phenomenon of dispersion is not clear to the students.	comprehension.
3d	K	14 9	89.4	In a P type semi-conductor the emitter is smaller than the collector	Confusion between P type semi- -condutor with a transister	conceptual.
3e	U	82.7	7 3	E = -ev, where e = emf E = Electric field V = potential	Lack the concept of e m.f and potential difference	conceptual
3f	U	85.6	22 2	Velocity of the electron in a wire is called drift velocity.	Drift velocity is confused with average velocity.	conceptual

Question No	Type of question	% of student attempted response	% of student giving correct committed	Indicators for error diagnosis/ specific examples of error	Diagnostic error by max no of students.	Types of error commited
3g	U+S	65.5	6.7	-	The fact that the emitter base junction is always forward biased and collector base junction is always reversed biased is not known to the students.	Diagram + concept.
3h	K	86 6	24 3	Algebric sum of the voltages meeting at a point is equal to zero	Not able to write the mathematicalexpression for Kirchoff's second law	Rote learning.
3i	U	66.1	7.5	The frame without accleration or moving with uniform velocity is called an inertial frame of reference	lacks the concept of inertial frame	conceptual.
3j	U+S	65 5	11 8		Basic connection of a diode valve and the symbol of a transformer are not clear to student.	Diagram

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
3k	K	91.1	32.7		Unable to explain different quantities involed in the equation	Rote learning
3l	K+A	77.7	17.1		Students are not aware of what is thumb rule and its use.	Diagram + concept
3m	U	8	7.6		The students unable to corelate Rutherford model of atom studied in chemistry.	comprehension
3n	A	62.7	5.3	Capacity of the condenser $= \frac{1 coul}{1 joul} = 1\ CJ^{-1}$	Unware of units and dimension	Problem solving
4	K+A+S	8.1	11.6	1. Fringe width is defined as the distance between two bright spot or two bright spot or two dark spot. 2. In many cases derivation is upto $X = \frac{Yd}{D}$	The concept of phase and path difference is not clearly brought by the students.	Diagramatic +Linguistic +comprehension

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
5.	U+S	58 8	4 7 .	Use of astronomical telescope not discussed by most of the students	1 Confusion between objective and eye piece 2. Lack the concept of sign conventions used in optics	concept.
6	U+S	87 2	14 6		The skill of drawing the diagram and using the appropriate expre- - ssion is absent in almost all the cases	Diagram + concept.
7.	U+A+S	62 7	1 7	1. $E = L \frac{di}{dt}$ and $i = \frac{-E_0}{WL} \cos wt$ 2 Phase diagram not drawn in most of the cases	Not answer of Kirchoff's law of voltages	Diagramatic + problem solving skill + concept

Question No	Type of question	% of student attempted	% of student giving correct response	Indicators for error diagnosis/ specific examples of error committed	Diagnostic error	Types of error commited by max no. of students.
8	K	73 3	6	- tracers is not clear to the students →	The concept of Radioactive -	conceptual
9	K+S	65 5	4 2	Energy bond diagrams differen - - tiating the three not properly drawn	The concept has not come out clearly in the absence of appro - - priate diagrams and explanation	conceptual
10	A+S	54 4	0 9	Forward biasing of a transister is represented as an amplifier	Concept of an amplifier and biasing are to be properly explained.	Diagramatic +concept.

CONCLUSION

5. CONCLUSION :

The following conclusions can be drawn from the table - 3 & table - 4

In paper - I (table - 3) question 1e was attempted by 91.3 % of pupils but only 10% had given correct response Hence such type of concepts should be delt very carefully Similarly the question 2b, 3g, 3h, 3j, 3m, and 3o are to be taken in the same footing as question 1e In long questions all concepts along with their application and ray diagram / circut diagram may be given emphasis in the teaching - learning process

From table 4 which deals with paper - II, it is clear that question 1b due to its ambiguity almost all students failed to answer it correctly Question 1f 88.8 % of pupils attempted but only 3 7% had given correct response This indicate that the question is difficult and more emphasis should be given during class room teaching Similarly question 1h, 2b, 2c, 2d, 2g, 3e, 3g, 3i, 3j, 3m, 3n are to be delt in the same footing as question 1f

The questions can be categorised according to the percentage of students giving correct response to a particular question

1 Questions attempted and given correct response by less than equal to 20 % of candidate are categorised as most difficcult question or very difficult question from candidate point of view

2. Questions for which correct response was given by more than 20% and less than equal to 35% are categorised as less difficult questions

3. Questions for which correct response was given by more than 35 % and less than equal to 50 % are categorised as averagely difficult questions

4 . Questions for which correct response was given by more than 50 % and less than equal to 65 % are placed as moderately difficult questions

5 Questions for which correct response was given by more than 65% of students are categorised as least difficult questions

Table 5 and 6 give the detail of these five categorises of questions for paper I and paper II respectively

TABLE NO: 5

CATEGORISATION OF QUESTIONS FOR PAPER - I

category no.	category name	criteria for category.	No of Questions in the category
1	most difficult	less than equal to 20%	1e, 2a 2b 2d. 3a, 3b, 3c, 3e, 3g 3h. 3j, 3k, 3m, 3o, 4, 5, 6 7 8, 9 10
2	less difficult	less than equal to 35% and more than 20%	1b, 1f 2f 3f, 3i 3l, 3n
3	Averagely difficult	more than 35% and less than 50%	1a, 1g 1h 2g
4	moderatly difficult	more than 50% and less than 65%	1c, 1d 2c 2e 3d
5	least difficult	more than 65%	

TABLE NO: 6

CATEGORISATION OF QUESTIONS FOR PAPER - II

category no	category name	criteria for category	No of Questions in the category
1	most difficult	less than equal to 20%	1b, 1f, 1h, 2b, 2c, 2d, 2g, 3e, 3g, 3i, 3j, 3l, 3m, 3n, 4, 5, 6, 7, 8, 9, 10
2	less difficult	less than equal to 35% and more than 20%	1c, 1d, 1e, 2a, 2e, 2f, 3f, 3h, 3k
3	Averagely difficult	more than 35% and less than 50%	1g
4.	Moderately difficult	more than 50% and less than 65%	
5.	least difficult	more than 65%	3a, 3b, 3c, 3d

While preparing the remedial teaching package utmost importance should be given to the concepts asked under category one questions and least importance to the questions under category 5 may be given. Table 5 and table 6 depicts these different categories of questions.

SUGGESTIONS

6. SUGGESTIONS :

The procedings of the meeting held on dt 10.10 96 to discuss the poor perfermance of the students in physics in general can be taken into account to improve the performance which will be reflected in the remedial teaching package

1. CHSE has neither published any text book on its own nor approved the books written and published by the private publishers as reference books

2. Since all schools / colleges are not following the books written by the some set of authors, but following different books in different regions, it is difficult to review the text books for their authenticity or to compare them against any standard text book

3 The general view was that the CHSE should publish its own standard text book by commissioning suitable authors as being done by CBSE (CBSE has commossioned NCERT to write the books)

OR

The objective of different important concepts in a given chapter should be briefly outlined in the begining of the chapter so that the readers will have an emphasis on them.

OR

Approve one book as Text - Book as was done by Utkal University For I sc during 1974 to1985, few chapters from college physics by Weber - Manning and White was choosen and the contents of the chapter were taken as courses of studies.

4. The topics to be covered should be explicitly written in the courses of studies (syllabus) to enable a teacher / student to deal with the subject matter.

5. Dupplication of topics like - physics of atoms (Bohr's theory), Nuclear physics, Binding energy etc may be dropped from physics

6. Necessary steps may be taken to identify topics covered in different entrance examinations and may be included in the courses of studies

7. To prevent arbitrary evaluation which is related with pupils error, a candidate may be permitted to get a xerox copy of his / her evaluated answer script on demand

EXAMPLE OF ARBITRARY EVALUATION :-

let us consider question 1d of paper - II The question is " Why the base thinner compared to emitter and collector in an n - p - n transistor"

Answer evaluated as correct and given full marks is :-

(i) The base in an n - p - n transistor is thinner than emitter and collector becuase due to this the electrons from emitter can pass through it and reach easily to the collector

Answer evaluated as wrong and given zero mark are as follows : -

(ii) It is due to the fact that electrons are easily moved between emmitter and collector.

(iii) Becuase if it is thick, more amount of electrons are neutralised. As a result more base current and less collector current will be produced.

In the evaluation though (i) & (ii) are identical answers in one case, full mark is given and in the other case zero mark is given. However both the answers are wrong. The answer (iii) though correct, given zero mark.

8. Emphasis should be given on the ray diagram in optics and circuit diagram in electricity and electronics.

9. The questions should be set from different parts covering all the units putting emphasis on knowledge and understanding basis instead of application and skill as envisaged in the questions of 1995. This is the main reason for the failure of pupils and 70 % of our objective questions are application and skill based.

While setting the question paper disproportionate distribution of markes should be avoided.

The questions specific without any ambiguity. Example of a non - specific question is - Why a galvanometer is called " dead beat ".

10. Questions above +2 standard should be avoided while setting the question.

11. Questions should be strictly set from the syllabus.

APPENDICES

APPENDIX - 1

Name of the Examination - CHSE, ORISSA

Year of Examination - 1995

Paper __________ Unit __________ Question No. __________

TYPES OF ERRORS

Code no	Conceptual	Linguitstc	diagramatic	Comprehenssion	Problem solving skill	Rote Learning	Answer incorrect
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total no.							

REMARKS 1) Question is wrongly framed - Y/N

2) Question asks for - Information / Knowledge / Application / Skill

3) Any other:

APPENDIX - 2

1995 (A)

Full Marks - 75

Time - 3 Hours

PHYSICS

Paper - 1

Annual Higher Secondary Education - 1995

Answer ***all*** *questions from Group - A, any* ***ten*** *questions*

from Group - B and ***four*** *questions from Group - C*

Answer the sort answer type questions of Group" A"

and Group"B" serially and continnuously.

The figues in the right hand margin indicate marks

Group - A

Each question carries **one** mark

[1 X 8]

1 (a) Write the dimension of Planck's constant.

(b) Under what condition the cross product of two non-zerovectors will be zero'

(c) The kinetic energy of a body is 10J If its momentum is doubled what will be its kinetic energy ?

(d) If the displacement - time graph is paralled to the t - axis what is the velocity of the body?

(e) What provides the centripetal force when a cyclist is taking a turn ?

(f) Give an example of a body having its centre of mass outside the body

(g) The mass of the moon is 1 / 9 that of the earth The value of the gravitational force of the earth on the moon is F newton What is magnitude of the gravitational force of the moon on the earth ?

(h) What is the time period of a simple pendulum inside an earth satelite ?

2. Each question carries one mark [1 X 7]

(a) How does the frequency of transverse vibration in a string depend on its mass per unit length ?

(b) When a longitudinal wave travelling in a denser medium get reflected from a rarer medium how much change of phase occurs?

(c) When a brush is dipped in water and then lifted why do the hairs get squeezed ?

(d) How much heat will be required to convert 15 gms of ice at 0°c to 15 gms of water at 0°c?

(e) Why the bottom of a cooking vessel is made black?

(f) Write the dependence of r. m s velocity of a gas on its pressure

(g) State Stoke's law

Group -B

3. Each question carries two marks. (2 X 10)

(a) Find out the condition under which the magnitude of the sum of two vectors is the sum of their individual magnitudes.

(b) Starting from rest and moving with uniform acceleration a body has a velocity of 2 m / sec after travelling 10m What will be its velocity after travelling 40 m ?

(c) State the condition of equilibrium of a body.

(d) Establish the relation between coefficient of friction and angle of repose

(e) Calculate the moment of inertia of a disc of mass 50 gm and radius 13 cms. about an axis passing through its centre and perpendicular to its plane

(f) A very heavy body moving with a velocity of 10 m / sec makes a head - on elastic collision with a very light body at rest What are the velocity of the two bodies after the collsion ?

(g) State Kepler's third law for planetary motion

(h) Starting from the mean position draw the acceleration - time graph for the oscillation of a simple pendulum

(i) Calculate the efficiency of a Carnot engine working between temperatures 127c and 227c

(j) The radius of a soap bubble is increased to double its initial size Calculate the percentage of change in the excess pressure inside the soap bubble

(K) Explain why roofs get blown off during storm

(l) State Stefan's law .

(m) The frequency of transverse vibration in a string is 240 when the tension 9 N By how much the frequency will change if the tension is made 25 N ?

(n) State the law of equipartition of energy.

(o) Establish the relation between specific heat and water equivalent of a body

Group - c

Each question carries **ten** marks (10 X 4)

4 **Derive** the expression for the potential energy of body when it is raised to a height of h. Show that the energy of a body falling freely under gravity is a constant

5 **State** the laws of friction Obtain the expression for the best speed at which to take the curve on a banked road having friction

6 **Establish** the expressions for the range and maximum height attained by a projectile. Prove that speed remaining constant the range is same for two angles for projection

7 **Derive** Newton's formula for the velocity of longitudinal waves Hence derive the formula for velocity of sound in gases

8 **State** Hooks law Define the three moduli of elasticity Due to a stress of 20 N / M^2 the percentage increse in the length of a wire is 0.001 Calculate the Young's modules

9 **Distinguish** between isothermal and adiabatic processes Derive the expressions for the work done in isothermal and adiabatic processes.

10. **Distinguish** between stationary and progressive waves

Group - c

Each question carries **ten** marks (10 X 4)

4 **Derive** the expression for the potential energy of body when it is raised to a height of h Show that the energy of a body falling freely under gravity is a constant

5 **State** the laws of friction Obtain the expression for the best speed at which to take the curve on a banked road having friction

6 **Establish** the expressions for the range and maximum height attained by a projectile. Prove that speed remaining constant the range is same for two angles for projection

7. **Derive** Newton's formula for the velocity of longitudinal waves Hence derive the formula for velocity of sound in gases

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9 **Distinguish** between isothermal and adiabatic processes Derive the expressions for the work done in isothermal and adiabatic processes

10. **Distinguish** between stationary and progressive waves.

1995 (A)

Full Marks - 75

Time - 3 Hours

PHYSICS

Paper - 2

Annual Higher Secondary Education - 1995

*Answer **all** questions from Group - A, any **ten** questions*

*from Group - B and **four** questions from Group - C.*

Answer the sort answer type questions of Group" A "

and Group"B" serially and continnuously.

The figues in the right hand margin indicate marks

Group - A

Each question carries **one** mark [1 X 8]

1. (a) **Define magnetic dip?**

(b) **Why the galvanometer is called ' dead - beat ' ?**

(c) State the relationship between the electric field and potential at a point ?

(d) Why the base is thinner compared to emitter and collector in an n - p - n transistor ?

(e) Name Two radio isotops used as tracers in medicine

(f) How does the de - Broglie wave - length and kinatic energy of a particle are related ?

(g) Give one example each of ionic and covalent binding

(h) What is the source of energy in fusion ?

2. (1 X 7)

(a) Give one example each of dia and para magnetic substances.

(b) Under what condition Lorentz transformation goes to Galilean transformation ?

(c) What is the meaning of threshold frequency in photo - electric effect ?

(d) Define self inductance.

(e) What is heavy hydrogen ?

(f) what is an objective lens ?

(g) Why concave shaped magnets are used in moving coil galvanometers ?

Group - B

Each question carries two marks.

3 (2 X 10)

(a) State two differences between nuclear force and coulomb force

(b) In the nuclear reaction

$_8O^{15} + y = {}_6C^{12} + t$

name the particles y and t

(c) For a given color of light, state the factors on which deviation of ray produced by a prism depends.

(d) State the difference between p - type and n - type semi - conductor

(e) Distinguish between e. m. f and potential difference.

(f) Explain 'drift velocity' of electron in a conductor

(g) Explain forward biasing in transistor circuits

(h) State Kirchff's lows as applicable to electrical net - works.

(i) Explain the meaning of inertial frame of referance

(j) Draw the circuit diagram of a diode valve used as a rectifier

(k) State Joule's law of heating

(l) State fleming's right hand rule and mention its use

(m) State limitations of Rutherford model of atom

(n) What should be the capacity of a condenser possessing one coulomb of charge to have one joule of energy ?

Group - C

Each question carries **ten** marks

4. Describe Young's double slit experiment for interference of light . Derive an expression for the fringe width with monochromatic light .

5. With a neat ray diagrm, give the principle and use of an astronomical telescope.

6. Derive the laws for connection of capacitors in series and parallel.

7. An a. c circuit contains a resistance and inductance in series Draw the circuit diagrm and calculate the currrent in the circuit .What is the phase of the current in the inductance with respect to applied e m f ?

8 Disscuss the radio isotopes as tracers in medicine and agriculture.

9 Discuss the classification of solids as conductors, insulators and semi-conductors on the basis of band theory

10 With necessry circuit diagram describe the use of an n - p - n tranistor as an amplifier

APPENDIX - 3

PROGRAMME

Duration and dates ·- 5 days (7.10 96 to 10.10 96)

Venue: - Extension Hall, RIE, Bhubaneswar

Time table

Time Date/day	10AM to 1 P M (11 30AM to 11 45 AM Tea Break)	1PM to 2 30PM	2 30 to 5 00PM (3 30PM to 3.45PM Tea Break)
7.10.96 Monday	Registration, Inaguration (10 to 11AM) M M.... ..(11 to 12 PM)	Lunch Break	Analysis of the answer scripts (VGJ)
8 10 96 Tuesday	Analysis of the answer scripts and reporting by participants .(JKM, PM)	-do-	Dialogue with the partcipants on genesis of the errors (SD,MAC, BKP)
9 10 96 Wed.day	Summerisation of the errors by the group leader (MAC, RCD.PM.)	- do -	Text book analysis in view of the genesis paper-1 (JKM, RCD, SD, PM).
10 10.96 Thursday	Text book analysis in view of the genesis . Paper -11 (JKM,RCD, SD, PM)	-do-	Summerization and development of strategies for remedial major (MAC, VGJ.)
11.10 96 Friday	Summerization	-do-	Valedictory.

List Of Participants

1 Sri Khirod Ku Paul
Associate Professor of Physics,
College of Basic science & Humanities, OUAT
Bhubaneswar

2 Sri Gauranga Prasad Das
Associate Professor of Physics,
College of Basic science & Humanities, OUAT
Bhubaneswar

3 Dr Jatindra Nath Mohanty
Reader in Physics,
J K. B. K College, Cuttack

4. Sri Annada Charan Patnaik
Reader in physics,
K B. D A. V College,
Nirakarpur, Khurdha

5 Sri Sandip kumar Ray
Lecturer in Physics,
Revenshaw College, Cuttack

6. Dr Gauri Sankar Roy
Sr. Lecturer in Physics,
Revenshaw College, Cuttack

7 Dr . Dibakar Mishra
Reader & H. O D in Physics,
P N College, Khurdha

8. DR. (Mrs.) Manorama Bhuyan.
Reader in Physics,
B.J.B. College, Bhubaneswar

List of Internal Resource Persons

Dr. (Mrs) Madhuri Mohapatra, Prog Co-ordinator

1 Mr M A. Chanrasekhar,
Reader in Physics,
RIE, Bhubaneswar

2 Dr J. k Mohapatra,
Reader in Physics,
RIE, Bhubaneswar.

3 Dr V. G. Jadhao,
Reader in Physics,
RIE, Bhubaneswar

4 Dr B. K. Parida,
Sr Lecturer in Physics,
RIE, Bhubaneswar.

Dr Patitapaban Mishra was invited as the export for the workshop